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INFORMATION ON USSR COALS USED FOR COKING

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Extension of Coking Raw Material Base

Mines of the Donbass and Kuzbass work a large number of seams the coal of which is delivered under one name, but the quality indexes, that is, the sulfur content, the coking properties, and the ash content of coal of specific seams, vary even within the bounds of the mine field.

In the frequent absence of adequate devices for separate yield of seams and for effective standardization, coking coal shipped from one mine varies greatly in its coking properties and in its sulfur and ash content.

In some Donbass mines, commercial coals consist of a mixture of coals which cake slightly and those which cake well. Up to 30 percent of lean, slightly caking coal often goes into the total mixture, whereas the participation of these seams in the general output varies according to specific periods of operations.

In other mines, commercial coal consists of a blending of gas coal and PZh coal, a mixture of K and PZh, or K and PS coals.

Charges in coke by-products plants contain sharply varying amounts of lean coal in place of PS, PS in place of K, gas and contractir (usadochnyy) coal in place of PZh, etc. This leads to a variation in the quality of the coke in mechanical properties and in sulfur content, a narrowing of the assortment of coals used in coking charges, and overconsumption of short-supply, well-caking K and PZh coals, which are supplied in a somewhat increased amount to the charge to insure the quality of the coke against variations in the quality of coals of specific mines.

If coals are correctly classified in groups according to their individual technological properties and if careful standardization of the coal is carried out at all stages, from the face to the coking chamber, it will be possible to expand considerably the raw-material base for coking and at the same time to improve the quality and uniformity of the coke.

In the Kuzbass, the extension of the assortment of coals for coking is dependent, first of all, on efficient exploitation of existing productive capacities. As a result of experiments with coal conducted in recent years and also of perfecting the technology of preparing it, a considerable amount of Kuzbass coal with lowered coking properties has been included in coking charges (coal from the Moshchnyy and Gorelyy seams, among others).

In the Donbass, the extension of the raw-material base for coking is taking the direction, first of all, of lowering the sulfur content of metallurgical coke, which is still very high (1.7-1.8 percent). About half of the reserves of basin explored to a depth of 600 meters consist of gas coal with a low sulfur content (up to 2.5 percent). Coals widely used for coking of types K, KZh, and PS with such a sulfur content make up only one third of the reserves. A considerable amount of low-sulfur coal (sulfur content up to 1.5 percent) exists among the lean, noncaking coals, which constitute up to 18 percent of the reserves.

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At present, the majority of southern coke by-products plants with coal-cleaning facilities use up to 18-20 percent gas coal in their charges. Experiments in coking conducted in the Stalino, Krivoy Rog, and Novo-Makeyevka plants and experimental blast-furnace smeltings have indicated the possibility of raising the proportion of gas coal still more, to 25-30 percent.

The Stalino Coke By-Products Plant, after carrying out experimental coking for a long time, is operating successfully on a charge of 25 percent G coal, 30 percent PS coal, and 45 percent PZh. Blast furnaces of medium size operate satisfactorily on coke from this new charge.

The Krivoy Rog Coke By-Products Plant operated for 24 days on an experimental charge consisting of 30 percent G coal, 29 percent PZh, 18 percent K, and 23 percent PS. The large blast furnace which smelted open-hearth iron on this charge operated smoothly.

The Moscow Coke By-Products, put in operation in 1951, succeeded in converting to the following charge: 30 percent G coal, 30 percent PZh, 20 percent K, and 20 percent PS. The coke obtained is used in blast furnaces of Tula, Lipetsk, and in other metallurgical plants of the Central Region. The long practice of the Moscow Plant and the positive experiments in the Krivoy Rog Plant permit considering a charge with 30 percent gas coal as promising good results.

The Novo-Makeyevka Coke By-Products Plant conducted experimental coking with the following charge: 40 percent G coal, 23 percent PZh, 15 percent K, 22 percent PS. According to the conclusion of the Ukrainian Metals Institute, the conversion to the experimental coke did not have any marked effect on the operation of the blast furnaces.

The introduction into the charge of gas coal has improved the output of the chemical products of coking, the benzene hydrocarbons and tars, and it has facilitated the delivery of coke from the oven chambers. However, an increase in the proportion of gas coals leads to a decreased total output of coke and also of metallurgical coke, facts which must be taken into account.

Very important too is the addition to the coking charge of lean coals, which are bituminous coals with a very low volatile matter content, less than 17 percent.

Before 1950, Donbass lean coal was not used for coking. Recently, experiments have indicated that low-sulfur lean coal may be used to obtain foundry coke and, in some cases, when it is finely crushed, also for blast furnace coke.

The Khar'kov Plant conducted experimental coking with charges containing lean coal from Mine No 5 bis of the Voroshilovugol' Trust, which had a 5-percent ash and a 1.3-percent sulfur content and which had been completely crushed to class 0-3 millimeters. Coke with the best indexes for mechanical toughness was obtained from charges mixed in the following proportions (in percent):

<u>PZh</u>	<u>K</u>	<u>PS</u>	<u>T</u>
50	25	15	10
60	15	15	10

In the Smolyaninovskiy and Khanzhenskoy coke by-products plants and also in the Mushketovskiy coke ovens, 10 percent of lean coal subjected to ordinary crushing was introduced into the charge after suitable experimentation. The new charge contained 10 percent T coal, 35 percent K, and 55 percent KZh. The quality of the foundry coke was somewhat lowered, but it still satisfied requirements of the standard.

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Special crushing installations were set up at the Novo-Makeyevka Plant to crush the coal approximately 100 percent to the 0-2-millimeter class. As a result, the plant obtains coke of satisfactory quality from a charge containing 5 percent T coal, 12 percent PS, 25 percent K, 16 percent G, and 42 percent PZh. The blast furnaces of the Makeyevka Metallurgical Plant imeni Kirov have been operating on this coke for a long time.

Considerable interest is also displayed in the use in the charge of long-flame D coal with a maximum volatile-matter content of over 42 percent and characterized by decreased caking or complete absence of it. D coal from the Kurakhovka deposit contains only about 2 percent sulfur.

Experimental coking of a charge containing 10 percent D coal in the Yenakiyevo Coke By-Products Plant in 1950 and 1952 indicated that blast furnaces of medium size (up to 800 cubic meters) can operate normally on the coke obtained. Best results are obtained from a charge with the following contents: 10 percent D coal, 17 percent G, 25 percent K, 48 percent PZh. Thus D coal replaces short-supply PS coal in the charge.

As in the case of G coal, charges containing D coal yield a lowered coke output but an increased output of chemical products. The possibility must be investigated of increasing a single load in a coke oven, the charge of which contains D coal by using microquantities of organic liquids. This will permit compensation for the noted lowering in the gross coke output.

The steady development of coal extraction in operating mines and the introduction of new seams and levels in place of worked out ones are changing considerably the character of the quality of coal being mined. In some cases, a mine begins to yield coal of a different type or technological group, or even fuel coal in place of coking coal, or vice versa.

Changes in the properties of coal during exploitation operations must be promptly revealed and taken into account to prevent losses of coal for coking. Coals must be investigated regularly, both for coking and fuel purposes. They must be periodically tested for plasticity, and the proportion of individual seams in the output must be determined. When coal suitable for coking is discovered among fuel coal particularly short-supply types or low-sulfur varieties, separate removal of these types must be arranged for so that valuable coals may not be lost in mixture with fuel coal.

In case of a sharp deterioration in the quality of commercial coals, in coking properties or sulfur content, the reason for this deterioration should be established through plasticity tests.

Technological Grouping of Certain USSR Coals

GOST 1280-48 specifies standard technological grouping of coals of the Kuzbass, Karaganda, and the Kizel Basin, based on plasticity indexes and the volatile-matter content.

With a volatile-matter content in the combustible mass of 24.5-25 percent and the thickness of the plastic layer 14 millimeters, the coals belong to group KZh, if the plasticity curve has a wavy or zigzag shape, and to KZh2, if the curve drops smoothly.

With a volatile matter content in the combustible mass of 22-25 percent and the thickness of the plastic layer 13-14 millimeters, coals may belong to group K or KZh2 and, with the volatile matter content 24.5-25 percent and the thickness of the plastic layer more than 14 millimeters, to group K or KZh. In both cases, coals must be divided according to the amount of plastic shrinkage, which, for groups KZh and KZh2, is more than 28 millimeters but for group K is not more than 28 millimeters.

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Technological Grouping of Coals for Coking for Eastern Regions

<u>Coals</u>	<u>Group Designation</u>	<u>Percent of Volatile Matter</u>		<u>Thickness of Plastic Layer (mm)</u>	
		<u>From</u>	<u>To</u>	<u>From</u>	<u>To</u>
Kuzbass					
Gas coal group I	G1	More than 37		17	25
Gas coal group II	G2	More than 37		13	16
Fat coal group I	Zh1	Less than 33		More than 25	
Fat coal group II	Zh2	33	38	More than 25	
Coking fat coal	KZh	24.5	28	14	25
Coking fat group I	KZh1	28	31	14	25
Coking fat group II	KZh2	22	25	12	14
Coking coal	K	19	25	13 or more	
Coking coal group I	K1	17	21	10	12
Coking coal group II	K2	17	21	7	9
Lean caking	TS	Less than 17		6	9
Karaganda					
Fat coal	Zh	--	--	20 or more	
Coking coal group I	K1	--	--	12	19
Coking coal group II	K2	--	--	8	11
Kizel Basin					
Gas coal group I	G1	--	--	11	13
Gas coal group II	G2	--	--	8	10
Fat coal group I	Zh1	--	--	19 or more	
Fat coal group II	Zh2	--	--	14	18

The Khar'kov Scientific Research Institute of Coal Chemistry (UKhIN) has worked out a technological grouping for Donbass coals, indicated in the following table. In the case of coals without a clearly determined demarcation in their volatile-matter content, the following is recommended:

1. Coals with a volatile-matter content of 26 percent and a plastic layer 21 millimeters or more thick are to be assigned to group KZh if the plasticity curve has a zigzag shape and to Zh1 if the curve is hump-shaped.

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2. Coals with a volatile-matter content of 35 percent and a plastic layer more than 21 millimeters in thickness are assigned to group G1 if the plasticity curve is zigzag in shape and to Zh1 and Zh2, depending on the thickness of the plastic layer when the curve is hump-shaped.

3. Coals are assigned to group PS2 only when there is obtained from them completely caked laboratory-crucible coke with absence of uncaked dust.

Technological Grouping of Coals for Coking for the Donbass

Trade Brand	Group of Coals	Conventional Designation of Group	Thickness of Plastic Layer (mm)		Percent of Volatile Matter	
			From	To	From	To
D	Long-flame, group I	D1	5	8	More than 42	
D	Long-flame, group II	D2	--	5*	More than 42	
G	Gas, group I	G1	16 or more		35	44
G	Gas, group II	G2	9	15	35	44
PZh	Fat gas	ZhG	12	20	26	35
PZh	Fat, group I	Zh1	21	29	26	35
PZh	Fat, group II	Zh2	30 or more		26	35
K	Coking fat	KZh	21 or more		18	26
K	Coking	K	15	20	18	26
PS	Additive caking, group I	PS1	8	14	12	26
PS	Additive caking, group II	PS2	--	7*	12	18
T	Lean	T	--	4*	Less than 17	

*Less than or equal to figure

Lists of Certain USSR Mines Which Produce Constituents of Coking Charges

The following mines in the Donbass produce coal suitable to enter into a coking charge (according to data for 1952):

Trust	Mine	Type of Coal
Gorlovskugol'	No 1 Kochevarka	PZh
	No 3 Kochevarka	PZh
	No 4/5	PZh
	No 5 imeni Lenin	PZh
	No 6/7	PZh
	No 11 bis	PZh
	No 19/20	PZh
	Ruduch-Velikan	PZh
	Komsomolets	PZh
		PZh

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Trust	Mine	Type of Coal
Kalininugol'	No 3 Solidarnost'	PZh
	No 5 Podzemgaz	K, PS
	No 8a imeni Stalin	K
	No 9	PZh
	No 71	K
	Zapereval'naya	K
Dzerzhinskugol'	imeni Kalinin	K
	Novo-Kondrat'yevka	PS, T
	imeni Rummyantsev	PZh
	No 3 imeni Artem	PZh
	No 8 Derezhovka	PZh
	Chegar	PZh
Ordzhonikidzeugol'	imeni Dzerzhinskiy	PZh
	imeni Voroshilov	PZh
	No 1/1 bis	G
	No 1/2 Krasnyy Oktyabr'	PS, T
	imeni Karl Marx	K
	Krasnyy Profintern	PS
Krasnoarmeyskugol'	Yunkom	PS
	No 1 Novo-Grodovka	G
	No 1 Tsentral'naya	G
	No 1 Rodinskaya	G
	No 1/2 Dobropol'ye	G
	No 3	G
	No 5/6 imeni Dimitrov	G
	No 12 bis	G
	No 17/18 imeni RKKA	G
	No 30 Kurakhovskaya	D
	No 40 Kurakhovskaya	D
	Stalinugol'	No 1 imeni Chelyuskinty
No 2/7 Lidiyevka		G
No 4/21 imeni Molotov		PZh
No 17/17 bis		PZh
No 19		PZh
No 29 imeni Stalin		PZh
No 30		PZh
No 31		PZh
Petrovo-Lidiyevka		PZh, K
		G
Kuybyshevugol'	No 1 Kamenka	PZh
	1/2 Smolyanka	G
	No 1/7 Vetka	PZh
	No 4 imeni Gor'kiy	G, PZh
	No 4 Livenka	PZh, K
	No 5/6 imeni Kalinin	K
	No 7/8 imeni Kalinin	K
	No 10-bis	G
	No 12 imeni F. Kon	G
	No 13 Nikopol'-Mariupol'skaya	PZh
	No 144	G
	imeni Gor'kiy	G
	Vladimir	G
	Proletarka	G, PZh
	Tsentral'naya Zavodskaya	G
	imeni Kaganovich	K
		G

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<u>Trust</u>	<u>Mine</u>	<u>Type of Coal</u>	
Budenovugol'	No 1/2 Livenka	PS	
	No 6 Krasnaya Zvezda	PS	
	No 6 Kapital'naya	PS	
	No 8 Chulkovka	PS	
	No 9 Naklonnaya	PS	
	No 9 Kapital'naya	PS	
	No 11/21	PS	
	No 12 Naklonnaya	PS	
	No 12/18 imeni Pravda	PS	
	No 16 Kucherovo	PS	
	No 16/17 Yevdokiyeveka	PS	
	Livenskaya Zapereval'naya	PS	
	Novo-Mushketovo	K	
	Mushketovskaya Vertikal'naya	PS	
	Makeyevugol'	No 1 Sofiya	PZh
		No 1 Almaz	K
		No 9	PZh
No 10 Kholodnaya Balka		K	
No 14/18 Kholodnaya Balka		K	
No 16 Kholodnaya Balka		K	
No 28 bis		K	
No 29		K	
No 34		PZh	
No 46 imeni Lenin		G	
No 51		K	
Gruzskaya Naklonnaya		PZh	
Proletarskaya Krutaya		K	
imeni Kaganovich		PZh, K	
Kapital'naya Markovka		PZh	
imeni Lenin		PZh	
Proletarskaya Glubokaya		PZh	
Krasnogvardeyskugol'	No 1 Shcheglovka	PZh	
	No 1 Ganzovskaya	PZh	
	No 3	PZh	
	No 23	PZh	
	No 6	PZh	
	No 6/13	PZh	
	No 6/14	G	
	No 12/13 Grigor'yevka	PZh	
	Mariya	PZh	
	imeni Ordzhonikize	PZh	
	Chaykinoyuzhnoye	PZh	
	Novo-Butovka	PZh	
	Sovetskugol'	No 1 imeni Kirov	K
		No 1 Kholodnaya Balka	PS
		No 3/5 Dutovka	G
		No 3/5 Yasinovka	PZh
		No 3 imeni Shmidt	PS
No 4/13 imeni Kirov		PZh	
No 12-bis		PZh	
No 13-bis		PZh	
No 19/20		PZh, K	
Yasinovskaya		K	
No 21 imeni Khrushchev		K	
Kapital'naya Nol'naya		K, PS	
Kirovskaya Zapadnaya		K	
		PZh	

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Trust	Mine	Type of Coal	
Krasnodonugol'	No 1-bis	K	
	No 1/2 Krasnodarskaya	PS	
	No 2 Severo-Gundorovskaya	PZh	
	No 2-bis	PZh	
	No 2-9 Krasnyy Oktyabr'	PZh	
	No 3-bis	PS	
	No 7 Izvarino	PZh	
	No 12	PS	
	No 17	PS	
	No 18	K	
	No 20	K	
	No 21 Sorokino	K	
	No 22	PZh	
	No 173	PZh	
	No 178	K	
	Churilino Vostochnaya	PZh	
	Churilino Zapadnaya	PZh	
	Uralokavkazskaya	G	
	Kadiyevugol'	No 3/3 bis	PZh
		No 4/2 bis	PZh
No 6 Maksimovka		PZh	
No 18		PZh	
No 36		PZh	
imeni Stalin		PZh	
imeni Il'ich		PZh	
No 1-bis Krivorozh'ye		K	
No 2/5 Kamenka		K	
No 4 Mazurovskaya		K	
No 5 Stal'		PZh	
No 6/6-bis		K	
No 11 Rau		K, PZh	
No 12 imeni Dzerzhinskiy		K	
No 21-bis		PS	
No 50 Galki		K	
Karmatorskaya		PZh	
Davydovskaya		PZh	
Voroshilovugol'		No 2 Del'ta	T
		No 5-bis	T
	No 6-bis Belyanka	PS	
	No 10 imeni Artem	PS	
	No 25	PS	
	No 19	G	
	Zapereval'naya	T	
	imeni Stalin	PS	
	Tsentrall'naya Belyanka	K	
	imeni Lenin	G	
Pervomayskugol'	imeni Voroshilov	K	
	No 1	PZh	
	No 4/5 Sokologorovka	G	
	No 4/6 Karbonit	G	
	Pervomayskaya	G	
	No 1 Bezhanovka	G	
	No 2 Bezhanovka	G	
No 1/2 Novo-Golubovskaya	G		

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<u>Trust</u>	<u>Mine</u>	<u>Type of Coal</u>
Pervomsyskugol'	No 4 Golubovskaya	G
	No 5	G
	No 6 imeni Kirov	G
	No 22 imeni Kirov	G
	No 77	G
	No 100-bis	G
	No 102	G
	Velikan	G
Gundorovugol'	No 1 Severo-Izvarinskaya	K
	No 3 Severo-Gundorovskaya	PZh
	No 12-bis	PS
	No 15-bis	K
	No 20	K
	No 21	K
	No 22	K
	No 54	K
	Yugo-Vostochnaya	K
	Yugo-Zapadnaya	K
Bogurayevugol'	No 5 Pastukhovskaya	PS
	No 6 Vail'yevskaya	PS
	No 13 Gorn'yatskaya	K
	No 23 Pastukhovskaya	PS
	Gorn'yatskaya Vostochnaya	K

The following Kuzbass mines produce coal suitable for use in coking charges (according to data for 1951 and 1952):

<u>Trust</u>	<u>Mine</u>	<u>Type of Coal</u>
Stalinugol	imeni Stalin	K, K2, SS
	imeni Molotov	K, K2
	No 3/3-bis	K, K2
	Vostochnaya	K
	Magar	K2
Prokop'yevskugol'	imeni Voroshilov	K, K2
	imeni Kalinin	K
	imeni Kaganovich	K, K2, SS
	Ziminka	K, K2
	Krasnogorskaya	K
	Mancikha	K2, SS
Kaganovichugol'	imeni Vakhrushev	K, K2
	No 1/2	K, K2
	No 4	K2
	Surtaikha	K
	No 7a	K
	No 76	K
Molotovugol'	Kapital'naya I	PZh
	Kapital'naya II	PZh
	No 4	PZh
	No 9	PZh

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<u>Trust</u>	<u>Mine</u>	<u>Type of Coal</u>
Kuybyshevugol'	Baydayevskaya	PZh
	Abashevskaya No 1	PZh
	Abashevskaya No 2	PZh
	Zyryanovskaya	G
Leninugol'	imeni Ye. Yaroslavskiy	G
	imeni Kirov	G
	Polsayevskaya I	G
	7 Noyabrya	G
Belovugol'	Babanakovskaya	PZh
	Pionerka	G
	Babanakovskaya II	PZh
Anzherovugol'	No 5/7	PS
	No 9/15	PS
	Fizkul'turnik	PS

Listing of Certain Donbass Coal-Cleaning Plants

An OF is a coal-cleaning plant serving one mine at which it is located. A TsOF is a central coal-cleaning plant and serves a group of mines. The following OFs and TsOFs are under the jurisdiction of the Stalinugleobogashcheniye Trust: OF Novo-Kondrat'yevka, OF No 4/5 Nikotovka, OF Komsomolets, TsOF Novo-Uzlovskaya, TsOF Kal'miusskaya, TsOF imeni Dzerzhinskiy, OF No 13-bis, OF No 1 Tsentral'naya, and OF No 1/2 Dobropol'ye.

The following OFs and TsOFs are under the jurisdiction of the Voroshilov-gradugleobogashcheniye Trust: OF No 1-bis Krivorozh'ye, TsOF Irminskaya, TsOF Bryanskaya, OF imeni Stalin, and TsOF Novo-Golubovskaya.

The TsOF Chumakovskaya is subordinate to Glavkoks.

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